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Final Report: IUE Grant 15th Episode

"Stellar Populations in Early-Type

Galaxies with Nuclear Star-Bursts"

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Final Report: IUE Grant 15th Episode
Stellar Populations in Early-Type Galaxies with Nuclear Star-Bursts
Purchase Order No. S-14606-F
Principal Investigator: Dr. Linda L. Dressel

A Multi-Band Study of the Stellar Populations in Early-Type Galaxies with Strong Nuclear Star-Bursts

Strong nuclear star-bursts are occurring in a significant fraction of S0 and early-type spiral galaxies. I have used far infrared colors and fluxes and optical spectra to find galaxies with the brightest on-going bursts. I have observed the ultraviolet emission of three of these galaxies with centrally concentrated bursts with the SWP camera on IUE. I have used RDAF data reduction programs to produce calibrated spectra and to produce spatially resolved images in IRAF and IDL formats for further analysis.

The SWP spectra of the observed galaxies are shown in Figures 1a, b, and c. The red-shifted absorption lines of Si IV at 1400 Å and C IV at 1550 Å are clearly visible in the brightest two spectra. These lines are signatures of early B stars and O stars, respectively. More careful reductions will be done with the weighted-slit extraction method of Kinney, Bohlin, and Neill to improve the signal-to-noise for all three spectra so that weaker absorption lines can be identified. This is particularly important for SWP 45254, for which emission is more conspicuous in the spatially resolved data than in the extracted spectrum. In collaboration with Mike Fanelli (GSFC), I will use a population synthesis fitting routine to determine the stellar populations indicated by these spectra. This information will be combined with the estimates of the populations of cooler stars determined from optical spectra to deduce the star formation histories of the galaxies.

Lyman alpha emission, well separated from geocoronal Lyman alpha emission by redshift, is strong in two of the spectra. In one of the galaxies, both the Lyman alpha emission and the ultraviolet stellar continuum emission are resolved in the spatial dimension, thus demonstrating that star formation is continuing in both of the bright blue clumps seen in optical images. Figure 2 shows the short wavelength end of the IUE image. It is centered on the Lyman alpha emission of the galaxy, with the lower level contours of geocoronal Lyman alpha to the left, outlining the image of the large aperture. A velocity shift is apparent along the spatial dimension of the Lyman alpha emission of the galaxy. I will use the Lyman alpha spatial, velocity, and luminosity information with H alpha images and spectra to investigate the nature of the Lyman alpha extinction. I have searched the IUE archives for SWP observations of other non-Seyfert star-burst galaxies with velocities high enough to separate their Lyman alpha emission from the geocoronal Lyman alpha emission, and have acquired the SWP spectra. I will use this sample to try to determine why some Lyman alpha emission escapes from some of these galaxies, while it is totally extinguished by most galaxies.

I anticipate writing two papers based on this data, in combination with IUE archival data and optical images and spectra. One will discuss the stellar populations of star-bursts in early-

type galaxies; the other will analyze the production and escape of Lyman alpha emission in starburst regions.

Image: SWP 45243 Center: 59

LARGE aperture Duration: 23220 seconds

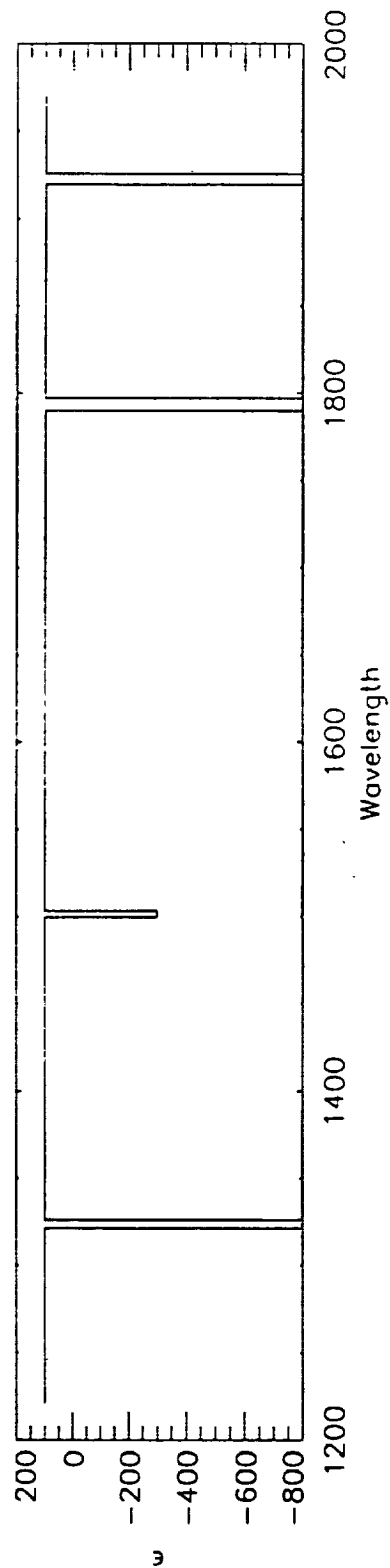
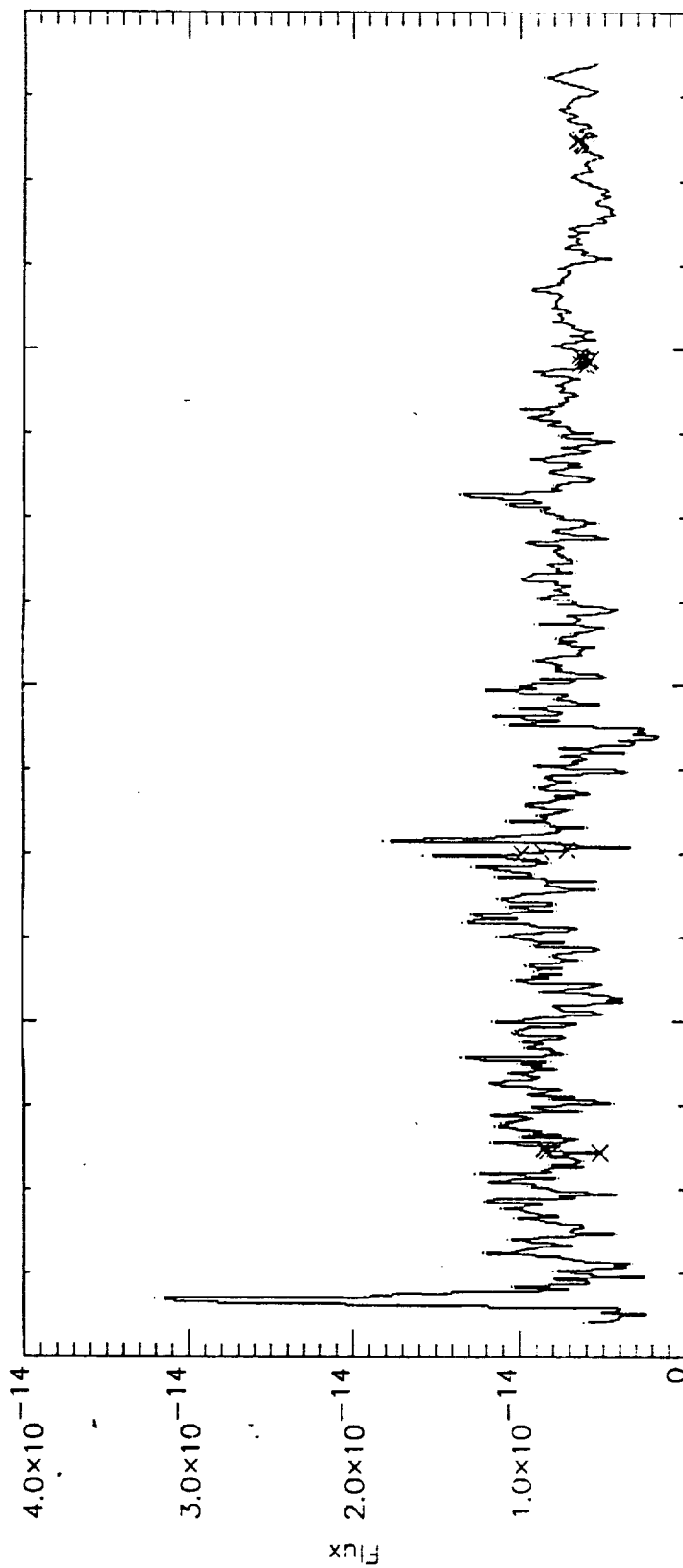


Figure 1a. The calibrated spectrum (erg/cm cm s \AA) and bad pixel plot of SWP 45243.

Image: SWP 45249 Center: 56 Current time: 28-Apr-1995 19:24:57.00
 LARGE aperture Duration: 24540 seconds

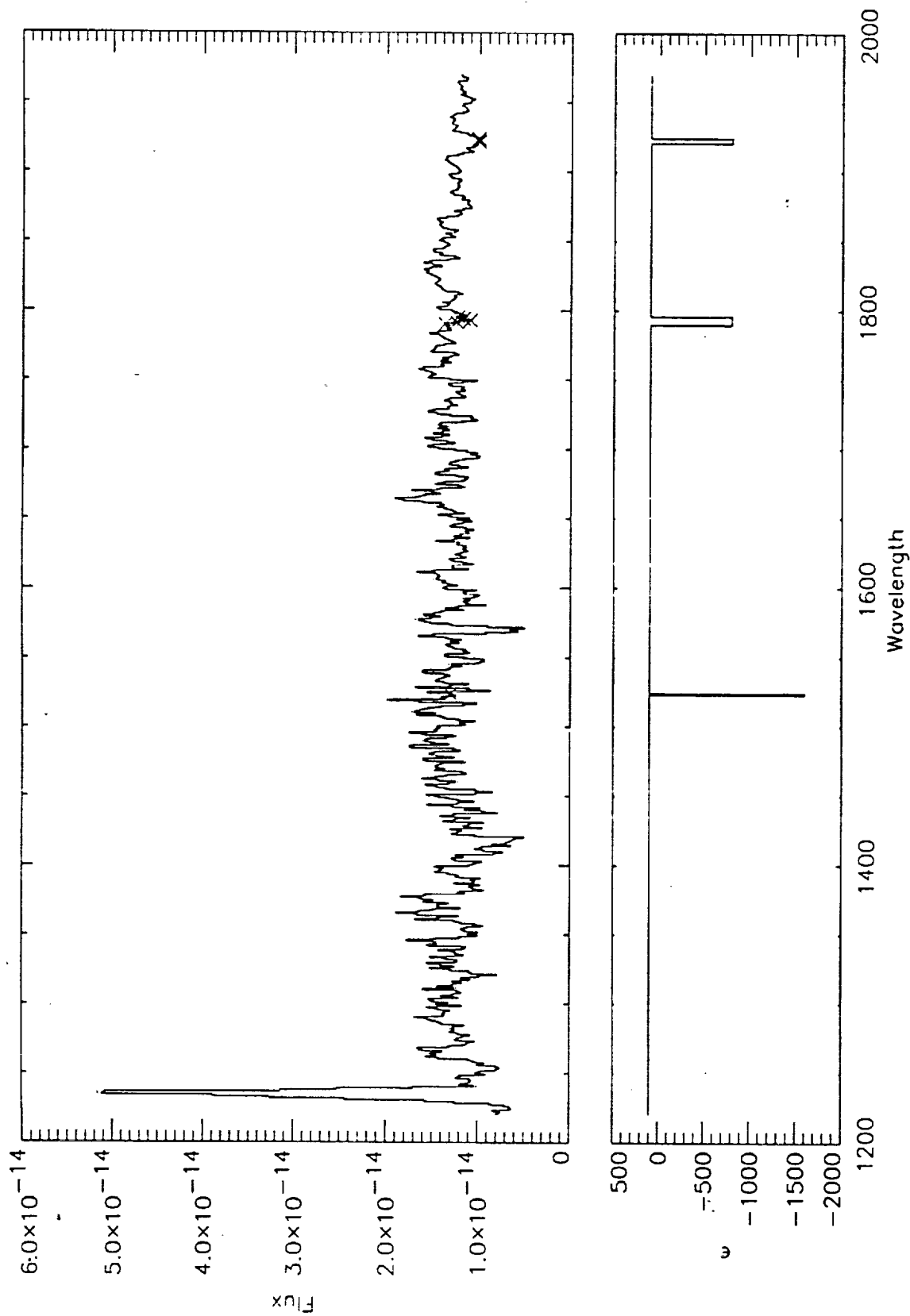


Figure 1b. The calibrated spectrum (erg/cm cm s A) and bad pixel plot of SWP 45249.

Image: SWP 45254 Center: 56

LARGE aperture Duration: 25200 seconds

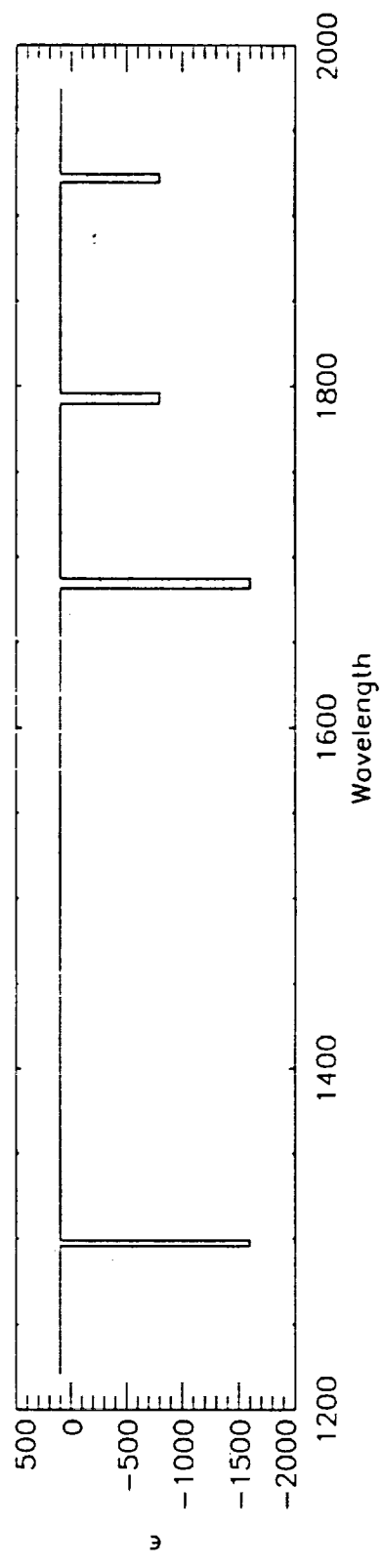
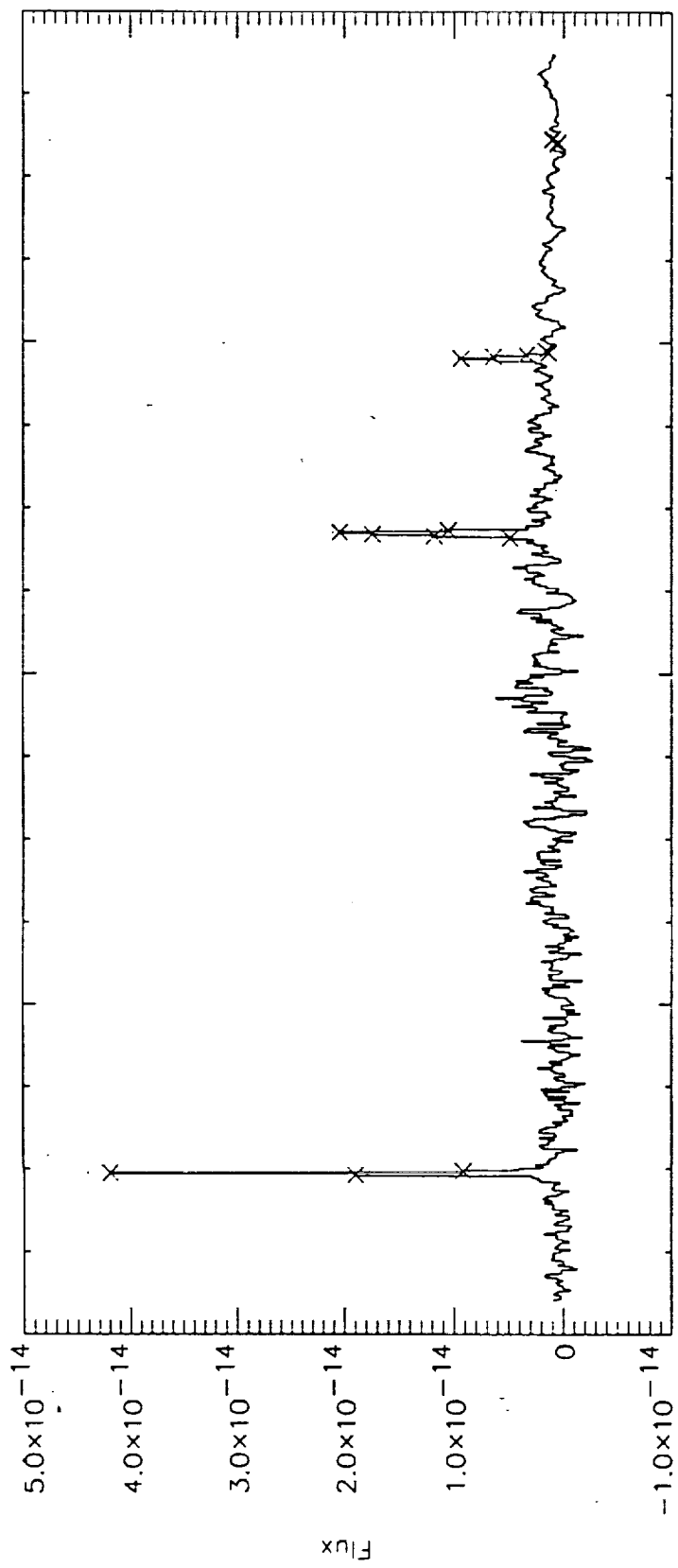
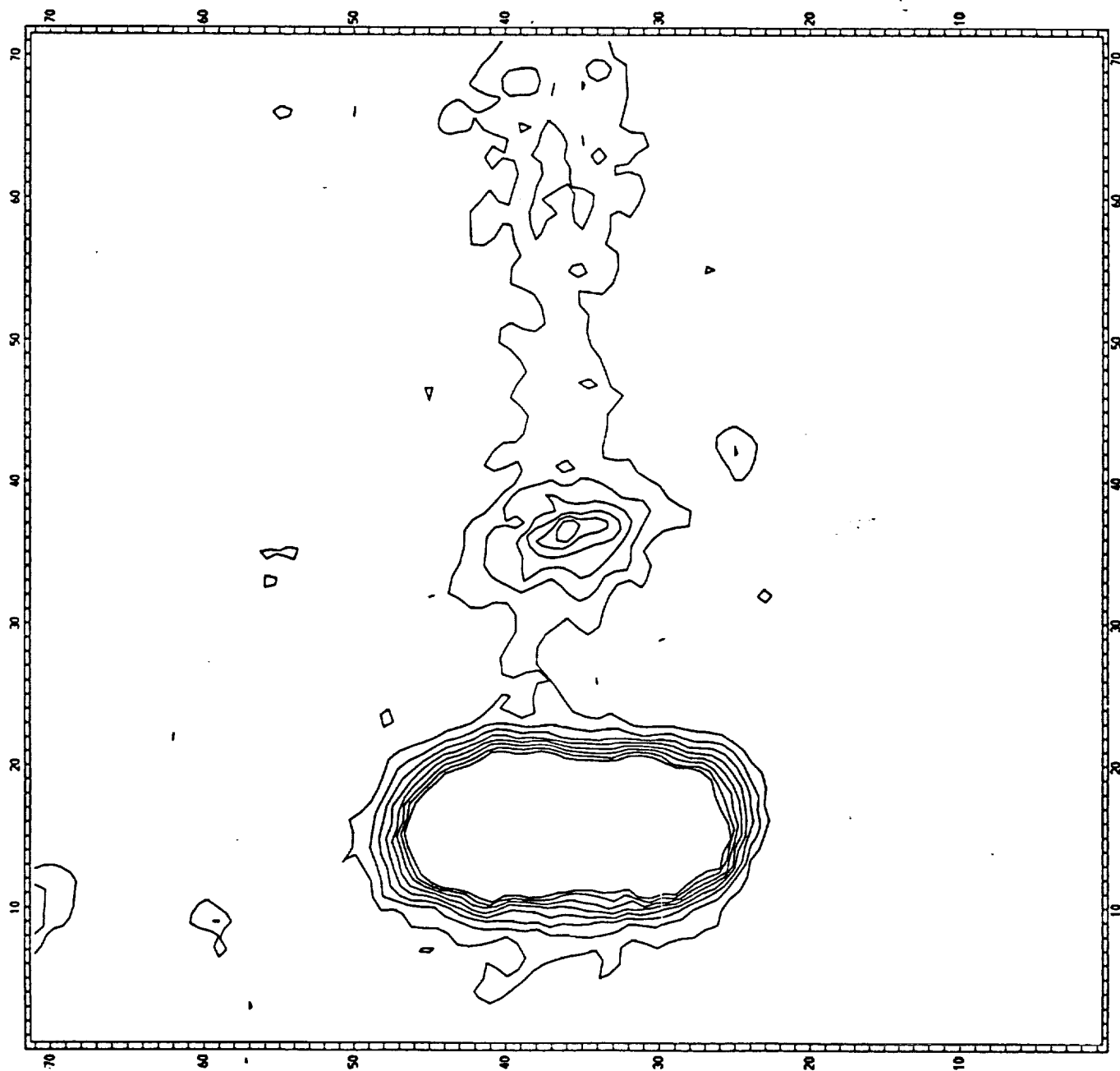


Figure 1c. The calibrated spectrum (erg/cm cm s Å) and bad pixel plot of SWP 45254.

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contoured from 2500. to 9500.. Interval = 1000.

Figure 2. The short wavelength end of the spatially resolved image of SWP 45249, centered on the Lyman alpha emission of the galaxy.



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16. Abstract SWP spectra have been taken of three early-type galaxies with bright nuclear star-bursts. Preliminary reductions show strong absorption lines due to O and B stars and strong Lyman alpha emission in two of the spectra. Both the stellar continuum emission and the line emission are spatially resolved in one of the galaxies, and the velocity of the Lyman alpha emission shifts in the spatial dimension. The star formation histories of the galaxies will be determined from population synthesis of the SWP spectra and optical spectra. The Lyman alpha emission will be studied in the context of SWP spectra of other star-burst galaxies with velocities high enough to separate their Lyman alpha emission from geocoronal Lyman alpha emission.					
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